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ABSTRACT

A simple device called a "wire labyrinth" was used in an experiment involving learning of a two-hand motor task. The Ss were asked, after completing each of 7 successive trails, to give their estimates of perceived (subjective) difficulty of the task. For this purpose, the psychophysical method of magnitude estimation was used. Time was measured as a criterion of performance. The sevenfold repetition of the task resulted in a drop of performance time from 61 seconds to 35 seconds, i.e., by about 43%, while the perceived difficulty decreased from the initial value of 10 to 5.2, i.e., by 48%. The course of both functions was fairly similar; the correlation coefficient of 0.96 showed a close relationship between perceived difficulty and time. It is suggested that, in the task employed, the estimation of difficulty was mainly based on the perception of time. (Author)

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PERCEIVED DIFFICULTY OF A MOTOR-SKILL TASK AS A FUNCTION OF TRAINING*

Bratfisch, O., Dornič, S., & Borg, G. Perceived difficulty of a motor-skill task as a function of training. Rep. Inst. Appl. Psychol., Univer. Stockholm, 1970, No. 11. - A simple "wire labyrinth" (Fig. 1) was used in an experiment involving learning of a two-hand motor task. The Ss were asked, after completing each of 7 successive trials, to give their estimates of perceived (subjective) difficulty of the task. For this purpose, the psychophysical method of magnitude estimation was used. Time was measured as a criterion of performance. The sevenfold repetition of the task resulted in a drop of performance time from 61 secs to 35 secs, i.e., by about 43 %, while the perceived difficulty decreased from the initial value of 10 to 5.2, i.e., by 48 %. The course of both functions (Figs 2 & 3) was fairly similar; the correlation coefficient of 0.96 showed a close relationship between perceived difficulty and time (Fig. 4). It is suggested that, in the task employed, the estimation of difficulty was mainly based on the perception of time.

Introduction

The study of motor skills is one of the oldest and most thoroughly studied topics both in basic experimental and in applied psychological research. Interest in this field increased particularly under the influence of industrial and technological development. Attention was mainly focused on objective performance as measured by quantitative criteria. This was undoubtedly justified, especially because of interindividual differences in motor abilities and the influence of training, learning, stress, drugs etc. An instructive view of the broad field of motor skill investigations can be found, e.g., in the work by Buxton (1953), Seashore (1953), Fleishman (1954), Guilford (1959) and many others. Nevertheless, it appears at present that this classical method should be complemented by some new approaches.

One of the new and promising approaches is to study the perceived or

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subjective difficulty of various human activities, since this parameter plays an important role in many everyday situations. Even without any deeper analysis it is obvious that an objectively measurable ability to perform some task need not be in line with the perceived difficulty of the given task, since the latter often depends on many variables such as personality factors, motivation, attitudes etc. As the perceived difficulty of human activities (and life situations in general) rather than an "objective" ability to cope with some task is very often decisive for the overall feeling of man's satisfaction with his life, it seems necessary to deal with these problems in a systematic way.

Research in this area was started a few years ago within the framework of modern psychophysics. Several pilot studies were carried out at the beginning of the sixties by Borg & Dahlström (1960) and Borg (1962) in the field of physical work. In this connection the idea was presented to use psychophysical methods to study perceived difficulty (Borg, 1961). In a pilot study it was then shown that this was possible for the study of difficulty of items in an intelligence test (Borg & Forsling, 1964). A similar topic was the subject-matter of another study by Bratfisch & Ekman (1969). A general survey of the theoretical and methodological problems involved has been recently given by Borg, Bratfisch & Dornič (1970). The present study represents a part of a broader project the aim of which is to probe in several areas of human activities, particularly with regard to some methodological questions connected with the usability and reliability of psychophysical methods.

The subject-matter of the present experiment was to study the perceived difficulty of a simple motor-skill task and its changes under the influence of a short-time training.

Method

A simple motor task, which served as a routine skill test in the Institute of Applied Psychology, was used. Preliminary experiments

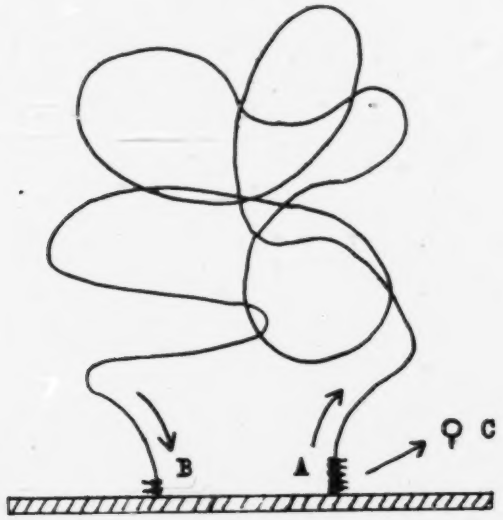

Fig. 1.

showed that its repetition resulted in rather rapid learning so that the task appeared suitable for the purposes of the present experiment.

A schematic drawing of the device, called a "wire labyrinth", is shown in Fig. a. The S's task was to transfer the small metal objects (C), by means of two 21 cm long and 4 mm thick metal sticks, from point A to point B. The overall length of the 2 mm thick wire, around which the objects (C) were loosely set, was 125 cm. The wire contained 13 bends in different angles. The maximum height of the whole device was 14 cm, the maximum width was 11 cm. A more exact description is given in a manual by Bratfisch and Lundgren (1967).

The Ss were instructed to complete the task as soon as possible, holding one of the sticks in each hand. The choice of motor strategies was left to the Ss themselves. The objects (C) were transferred one by one.

Preliminary experiments showed that successful learning required continuous concentration of attention; therefore, rapid repetition of the task (i.e., when the Ss started each task immediately after completing the preceding one) led, after the initial improvement of performance, to its impairment, which distorted the normal course of learning. This undesirable effect was at least partly removed by inserting 20 second pauses between the individual trials. The number of repetitions was limited to 7.

The time necessary to complete the individual tasks served as the index of the "objective difficulty" of the task. Perceived difficulty was measured by the psychophysical method of magnitude estimation. The perceived difficulty of the first trial served as standard for all the other trials and was denoted 10. If the S felt, for instance, that a given task was half as difficult as standard, he should report 5, etc. It was impressed on the Ss that they were to give their estimates on the basis of a general feeling of difficulty and to avoid using any additional cues such as time estimation, number of failures etc.

Because it was expected that the Ss would not be able to entirely avoid using the above cues, particularly time estimation, the original project of the present experiment also involved the Ss' estimation of perceived time. It turned out, however, that there was mutual influence and interference between the two estimates (difficulty and time) after each trial; consequently, the Ss were asked to give their estimates of difficulty only.

Fourteen university students ranging in age from 21 to 31 years participated in the experiment. Half of them were males. Only a few of the Ss had previous experience with scaling methods. The average duration of the experiment was about 10 minutes.

R e s u l t s

Medians were calculated both for the "objective difficulty" as expressed in time necessary to complete the tasks, and for the perceived difficulty. Fig. 2 shows this time as a function of trials. Except for Trial 2, the decrease is rather uniform; learning curve, typical of motor skill tasks,

is not to be seen: the number of trials is too small. Fig. 3 shows the decrease of perceived difficulty as a function of trials.

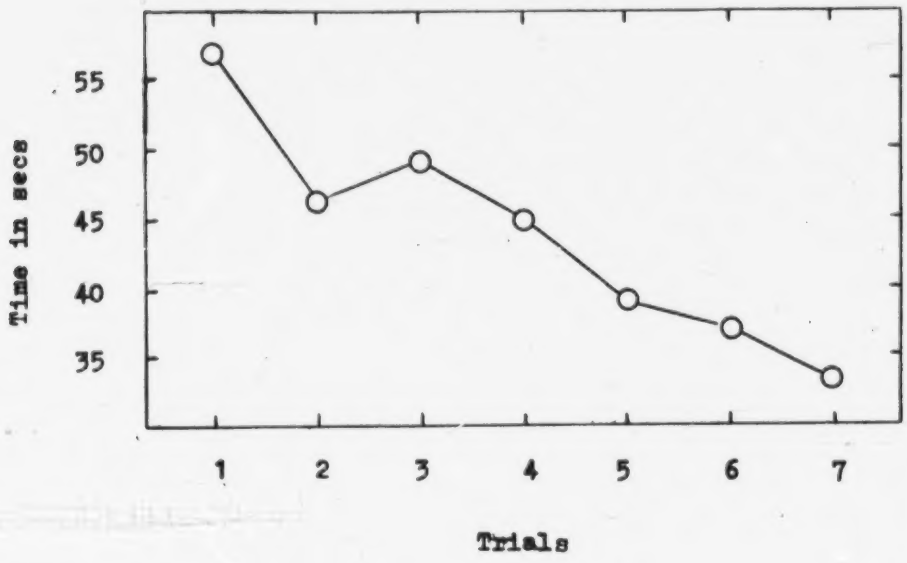

Fig. 2. Performance time as a function of trials

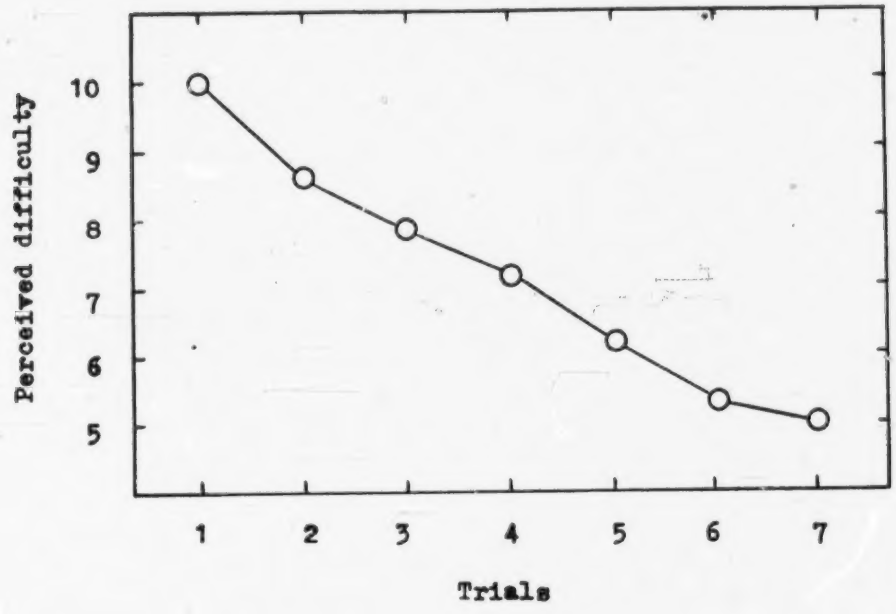

Fig. 3. Perceived difficulty as a function of trials

The relationship between perceived difficulty and time is shown in Fig. 4. The coefficient of correlation is 0.96. It seems

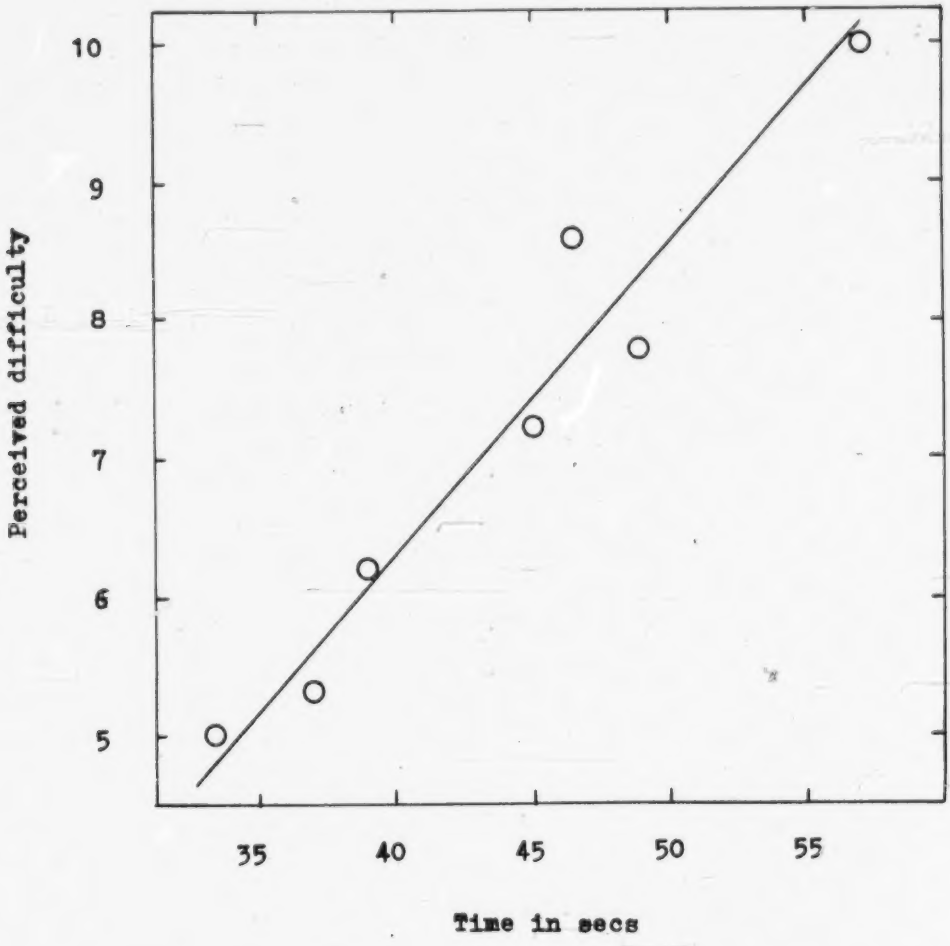

Fig. 4. The relation between perceived difficulty and performance time

obvius that time has played an important role in the estimation of perceived difficulty.

As far as the relationship between changes in time and changes in perceived difficulty is concerned a contradictory change in time and perceived difficulty took place only in 9 cases out of 84 individual cases (i.e., a bit more than 10 %): in 7 cases there was a decrease in perceived difficulty with increasing time and in 2 cases perceived difficulty increased while time decreased. The small number of such contradictory cases supports the above suggestion that time perception might have considerably influenced the estimation of difficulty.

D i s c u s s i o n

The main finding in the present experiment was the linear relationship between the perceived difficulty and objective performance. It should be emphasized that in this particular task, time is the best criterion of performance - no other criteria are available such as correctness in memory experiments, intelligence tests etc. In this sort of so-called neutral task of short duration, it is comparatively easy to perceive and estimate time, and the relation between objective and perceived time is more or less linear (cf., e.g., Gregg, 1951; Ekman & Frankenhaeuser, 1957; Frankenhaeuser, 1959).

Though, as mentioned above, perceived time could not be measured in the present group of subjects, it seems probable that a similar relationship would be found between perceived time and performance as was the case with objective time in the present experiment. It is, of course, quite possible that the relation between performance and perceived difficulty will be entirely different in tasks which do not enable the subject to perceive time in such a degree as in the present experiment - i.e., either in less "neutral" tasks or in those whose duration is too short or too long or where the task requires a continuous concentration and shifting of attention.

The above gives rise to an essential question: how can perceived difficulty be defined? What factors and variables does it depend upon? Is it a "genuine" psychological experience or is it determined by some mediated, secondary factors? It will be the aim of further experiments in other areas to answer these questions. As far as motor-skill tasks are concerned, it appears necessary to compare the present results with motor-skill tasks which make it possible to gain a complete learning curve and in which the objective measure of performance is represented by more criteria than time.

It also might be worthwhile to pay attention to different variables which probably influence the changes in perceived difficulty during learning. It seems possible that, e.g., strong motivational factors resulting in Ss' hard endeavor to achieve in each trial the best performance possible, might lead to no decrease in perceived difficulty during learning. This problem will also be the subject-matter of further studies of the present authors.

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